CS 70 SPRING 2007 — DISCUSSION #6

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1. Administrivia

(1) Course Information
- There will be a midterm review session next week.
- You need to consult 3 other CS70 students for homework 5.

2. Error Correcting Codes - Erasure Errors or Known Error Positions

In lecture, we learned an error-correcting scheme that allows us to correct k errors by adding k more characters to the transmitted message. This ability is quite useful in communications where we know we lost characters (such as noise or random disconnections on a line where it is very clear what noise is, etc...).

Let us review how this process works. Reconstruct the following statements in the alphabet $A = 0$, $I = 1$, $N = 2$, $S = 3$, and $T = 4$, knowing that the message size is 3 (the number of acceptable erasures is 1). Note that you are solving for a quadratic polynomial modulo 5.

(1) S_II
(2) _TIS
(3) SI_I

Exercise 1. Figure out the dropped letter at each level.
Concatenate the 3 character words together. Do you see the message?

3. Error Correcting Codes - General Errors or Unknown Error Positions

In modern day communications, most data is transmitted in the digital domain. This change makes it hard to determine what is noise or an omission in the data, so the error correcting scheme must be improved. Specifically, the error correcting scheme must tell you where the errors occured and allow you to decode the original message. In fact, CDs and other storage devices contain a large amount of redundant data.

The main idea is to add k more characters to the message such that message may be decoded. To follow this procedure, we add another polynomial $E(i) = (x - e_1) * (x - e_2)...(x - e_k)$ whose zeros are at the positions of the errors and then solve $Q(x) = P(x) * E(x)$. Note that E will have k coefficients as well, and that is why we need to extend the size of the message sent to be $n + 2k$ characters long.

Date: February 23, 2007.

The author gratefully acknowledge the TA's of CS70 past for the use of their previous notes: Chris Crutchfield, Amir Kamil, David Garmire, Lorenzo Orecchia, and Ben Rubunstein. Their notes form the basis for this handout.

Exercise 2. Suppose you received 42145 through a noisy channel that changes a packet in every five packets. What's the length of the initial message? Figure out the initial message, knowing that you are working on GF(7).